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Psychosocial factors affecting parental report of symptoms in children: a systematic review

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Abbreviations: ADHD = attention-deficit hyperactivity disorder; SDQ = strengths and difficulties questionnaire

Table of Contents Summary: This study systematically reviews the literature investigating parent and child psychosocial factors associated with parental report of symptoms in one's child.

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Abstract

Objectives: Parents make important treatment decisions for their children based on symptoms they perceive their child to be experiencing. Multiple psychological factors are associated with subjective symptom perception, but factors affecting perception of symptoms in others have been explored less. We systematically reviewed the literature to identify parent and child psychological factors associated with parental report of physical symptoms in their child.

Methods: We searched Embase, Ovid, PsycINFO and Scopus for studies which investigated associations between psychological factors and parental report of symptoms in their child.

Results: Thirty-six citations reporting on thirty-four studies which assessed the association between parent or child psychological factors and parental report of physical symptoms in the child were included in the review. Three main factors were identified as being associated with parental symptom report. First, there was evidence for an association between parental symptom report and affect, in particular parent and child anxiety. Second, child behavioural and conduct problems, and temperament-related challenges (problems with feeding and sleeping), were associated with parental symptom report. Third, parental expectations and beliefs that symptoms will occur were associated with parental symptom report, although few studies investigated these associations.

Conclusions: Parent and child affect, and parental expectations and beliefs, may influence parents' cognition, causing parents to pay more attention to their child, interpret their child's behaviour as symptomatic and recall symptoms in the child. Given the importance of parental perception of symptoms in driving decisions around care, additional research in this field is needed.

Keywords: symptoms; child symptoms; psychological factors; parents

Symptom perception is a complex process. While a clear correspondence between pathology and symptom occurrence and severity was once presumed, there is now convincing evidence that psychological factors, such as the wider context, the behaviour of others and the attitudes of the person involved, can influence whether one perceives a symptom (1). Models of subjective symptom perception postulate that bodily sensations lead to symptom experience through cognitive processing such as attention to the bodily sensation and interpretation of the sensation as a symptom (see Van den Bergh et al. (2) for summary). Psychological factors such as trait negativity, health anxiety, and learning are proposed to moderate these processes. However, relatively little research has investigated factors affecting the perception of symptoms in someone other than oneself, such as a child or dependent.

The ability to accurately identify symptoms in others is particularly important for parents. If parents are unable to accurately perceive symptoms in their child, they might incorrectly detect or miss signs of illness, symptoms of allergy or intolerance, or side-effects of medications, and make inappropriate decisions for their child regarding medical care, lifestyle, or medication adherence as a result. Perceived food intolerance is one example of this. Approximately one-third of parents believe their child has a food sensitivity (3).

However, the majority of these children do not undergo any formal testing of food allergy such as skin prick tests or oral food challenges. When formal testing does occur, the actual prevalence of food hypersensitivity is much lower (approximately 1.9% to 4.5%) (3, 4).

Although formal data are scarce, one study based on parental report estimated that 56% of children aged three to five have experienced symptoms such as headache, stomach ache, tiredness and dizziness in the last fourteen days (5), a broadly similar rate to that seen in adults (6-8). However, agreement between parent-reported and child self-reported symptoms is varied. For example, one study found that while parent-child agreement was relatively high for headache frequency, agreement was lower for other pain symptoms (9). Another study

reported similar results, finding that parent and child symptom report were highly correlated in children with recurrent stomach aches, but were less strongly correlated in well-children and not correlated in children with emotional disorders (10). These results suggest that the process of parental perception of symptoms in one's child is not straightforward and may depend in part on the type of symptom observed.

Multiple psychological factors have been identified as relevant in subjective symptom perception. In particular, heightened symptom expectations (11, 12), psychological traits such as anxiety (13), depression (14) and negative affect (15), and beliefs relating to exposures that might trigger symptoms (16), have also been associated with symptom reporting. Yet it is unclear if the predictors of symptom perception in oneself are the same as those for perceiving symptoms in one's child. While perception of symptoms in oneself is driven by detection of internal cues and bodily sensations, parental perception of symptoms in a child relies on external cues, such as observations of the child's behaviour, or listening to and assessing self-reports from the child. Parents of young or severely disabled children who are unable to verbalise their bodily sensations, may have to rely solely on observation of the child's behaviour.

Psychological factors known to be influential in subjective symptom perception may also affect parents' perception of symptoms in their child. Parents with higher trait negativity may pay more attention to their child's behaviour, be more likely to interpret their child's behaviour as symptomatic, and recall symptoms perceived in the child more readily or frequently (2). Parental expectations for symptoms to develop and beliefs about symptoms may influence these cognitive processes. The child's behaviour, affecting how children display symptoms experienced, may also influence parental symptom perception. It is likely that all three factors are important and interact with each other. In order to identify parent and child psychological factors which are associated with parent-report of physical symptoms in

one's child, we conducted a systematic review of the available literature. We used search terms relating to parents, perception of symptoms and symptoms that children might commonly experience.

Methods

We conducted a systematic review in accordance with PRISMA criteria (17), to identify factors associated with parental perception of symptoms in children. We searched Embase, Ovid and PsycINFO through OvidSP and Scopus. The final search used the terms (Parent* ADJ3 (perception OR perceive)) AND (side effect OR symptom* OR pain* OR asthma*). Asthma was included in the search terms as it is a condition experienced commonly in childhood, which was prevalent in our preliminary searches. MeSH terms were also searched where possible. Databases were searched from inception to 12th July 2018. References and forward citations of included articles were also searched.

Inclusion criteria

The following inclusion criteria were used:

Participants: Studies were included if they investigated parents of children aged zero to eighteen years. Studies were excluded if parents discussed symptom report outcome measures with their child or if it was unclear whether the parent or the child completed outcome measures.

Predictors/Exposures: Studies were included if they investigated the association between psychological or social factors and parental report of symptoms.

Outcomes: Studies were included if the outcome was parental report of physical symptoms in the child, including pain, asthmatic symptoms, side-effects from medication, or perceived allergy or food intolerance. Outcomes relating to parental contact with health professionals

following symptom perception were excluded. Outcomes based on parental report of a diagnosis for the child by a healthcare practitioner were also excluded.

Study reporting: Only studies published in English were included.

Data extraction

We extracted information about study design, inclusion criteria, number of participants, child age, symptom type, symptom measure used, and predictors of symptom report.

Risk of bias

Risk of bias was measured using an amended version of the Downs & Black checklist (18), as in previous systematic reviews (19). The Downs & Black checklist assesses the methodological quality of randomised and non-randomised studies (18). This version did not include items referring to interventions as they were not relevant for any included study. The Downs & Black checklist has been validated (20) and is suitable for use in systematic reviews (21). Five aspects of the studies' methods were assessed: reporting (out of ten), internal validity (bias; out of three), confounding (selection bias; out of three), external validity (out of two) and statistical power (one item). Scores were added to give a total of up to nineteen. We rated studies as good quality if they scored sixteen or over, moderate quality if they scored eleven to fifteen, and poor quality if they scored ten or less. Studies scored poorly for: reporting if they scored six or under; internal validity (bias) and confounding (selection bias) if they scored one or under; external validity if they scored one or under; and if they did not include a justification for the sample size used.

Procedure

LS came up with the search terms, carried out the search, screened papers, extracted data and completed risk of bias assessment with guidance from GJR. All authors helped devise the

idea for the review, assisted with interpretation of results and critically reviewed and revised the manuscript. Factors were grouped according to psychosocial factor.

Results

Study characteristics

3765 citations were found by the original search. After removing duplicates, 3232 citations remained. After title, abstract and full-text screening, seven citations remained. Reference searching and forward citation tracking identified a further twenty-nine citations which met the inclusion criteria, giving a total of 36 citations reporting on 34 studies (see Figure 1).

Twenty-three studies used a cross-sectional design, eight used a cohort design and three used case-control design (see Table 1). Nine studies investigated somatic symptoms in general, with a further nine investigating solely headache, three investigating stomach ache, and two investigating both headache and stomach ache; one investigated recurrent symptoms (see supplementary materials). Six studies investigated pain. Two studies investigated the incidence of symptoms in response to vaccination; one investigated symptoms attributed to food allergy; and one investigated symptoms attributed by parents to various ailments such as the common cold.

Risk of bias

Scores ranged between three and sixteen out of a possible nineteen (see Table 1). The majority of studies were poor quality (n=19), with twelve moderate quality studies. There were three good quality studies. Only four studies gave a justification for the sample size used (28, 42, 49, 50) (see Figure 2). With respect to internal validity, ten studies scored poorly for confounding (26, 32, 33, 35, 36, 41, 48, 51-53) and thirteen scored poorly for bias (5, 23, 25, 26, 32, 35, 36, 38, 41, 48, 52, 53, 56). External validity was acceptable in only four studies (30, 38, 49, 54). Reporting was poor in twenty-four studies (5, 22-38, 44, 48, 51-53, 56).

Only studies that were moderate or good quality are reported narratively.

Instruments used to measure parental perception of symptoms

Studies used many different measures of parental perception of symptoms. Few studies used validated questionnaires to measure parental perception of symptoms. Three studies used the parent-report version of the Children's Somatization Inventory (57), with another study using the short version; one study used the Child Behaviour Checklist (58); one study used a modified version of the Memorial Symptom Assessment Scale (59); and another used the non-communicating children's pain checklist-revised (60). All other studies used their own measure of parental perception of symptoms; this was often a single item asking how frequently the child had experienced a given symptom over a certain time period (see supplementary materials for full details).

Predictors of parental symptom report

Parent and child psychosocial factors associated with parental report of symptoms are reported in Table 2. Where studies used adjusted analyses, only these are reported. Many studies used the Strengths and Difficulties Questionnaire (SDQ; (61)), which is made up of five components: emotional problems, conduct problems, hyperactivity-inattention, peer problems and prosocial behaviour. Where possible we have reported each component individually.

Parent psychosocial characteristics

There was some evidence for associations between parental affect and parental symptom report. Evidence was stronger for a role of parental anxiety than other psychological traits or stressful events. Studies measured trait anxiety, apart from two which investigated anticipatory and experienced anxiety (51, 52) and another which used the Crown-Crisp index (45-47). One study found an association between parent anxiety and report of somatic symptoms (55), while three studies found mixed evidence of an association with increased

report of child chronic pain, recurrent stomach aches and perception of side effects from influenza (40, 45-47, 50). One study found evidence for an association between maternal depression and reporting of recurrent child symptoms (45-47), while two studies (34, 55) found no association between parental depression and presence and frequency of parent-reported somatic complaints and child pain. Parental post-traumatic stress disorder (PTSD) was associated with symptom report (44). There was mixed evidence for an association between parent distress or stress and parental symptom report. Distress was associated with frequency of parent-reported pain in one study (30). Three studies investigated the association between parental stress and parent-reported symptoms. One investigating somatic symptoms found an association (55); one investigating recurrent stomach aches found mixed evidence for an association (39); and one investigating general physical symptoms found no association (27). Paternal, but not maternal, low emotional support was associated with report of recurrent stomach aches (39).

Few studies investigated the association between parental behavioural factors and parental symptom report. One study found an association between punitive behaviours and less frequent report of headaches (43).

There was some evidence for an association between negative parental beliefs and attitudes and parental symptom report. Two studies investigated the association between parental reporting of side-effects from the child influenza vaccine and multiple parental beliefs, such as believing that vaccines cause side effects, and attitudes, such as not liking vaccines in general (49, 50). Beliefs and attitudes were associated with parental report of side-effects in both studies (see supplementary materials for full details). One of these studies also investigated parents' expectation that their child would experience a symptom, finding an association between parental expectation of side-effects and later side-effect reporting (50).

Child psychosocial characteristics

There was mixed evidence for associations between child affect and parental symptom report. Evidence was strongest for an association between parental symptom report and child anxiety, emotional problems and attention-deficit hyperactivity disorder (ADHD). Child emotional problems were associated with parent-reported frequent or severe headaches in two studies (43, 54), while another study found mixed evidence for an association with reporting of recurrent symptoms (45-47). Studies investigating child anxiety used measures which could be used as diagnostic tools for general anxiety disorder. Increased parent-reported presence, frequency and severity of headaches were associated with child anxiety in two studies (22, 43). One study investigated parent-reported child anxiety (22), while the other investigated child-reported anxiety (43). One study found an association between ADHD and frequency and severity of parent-reported headache (54), while another found mixed evidence for an association with recurrent stomach ache (45-47). One study found no evidence for an association between ADHD and frequency of parent-reported headache (43). Two studies (22, 43) found no association between child depression (parent-reported child depression (22), child-reported depression (43)) and presence, frequency and severity of parent-reported headache. Parent-reported anxiety and depression was not associated with parental report of recurrent headache (42). Three studies found no association between adverse or stressful life events and parent-reported headache or stomach ache (27, 39, 42). There was also no evidence for an association between oppositional defiant disorder, social phobia or separation anxiety and parent-reported frequent headache (43).

There was some evidence for an association between child behavioural factors and parental symptom report. All studies which investigated whether total high difficulties on the SDQ were associated with parental symptom report found evidence for an association (28, 30, 43, 45-47, 54). Conduct problems were associated with parent-reported recurrent stomach ache in

one study (45-47), while another investigating parent-reported headaches found mixed evidence (54). Temperament-related challenges, such as problems with feeding or sleeping, were also associated with parent-reported recurrent stomach ache (45-47). Evidence for an association between child problematic relationships with peers and parental symptom report was mixed, with one study investigating parent-reported headaches finding an association (54); two further studies investigating parent-reported headache and recurrent abdominal pain found no association (43, 45-47).

Discussion

While mechanisms underlying symptom perception in oneself are more clearly understood, less research has explored psychological factors associated with parental perception and report of symptoms in one's child. Our review identified three broad categories of factors affecting parental report of symptoms: affect; behaviour; and expectations and beliefs about symptoms. These build upon categories previously identified in the literature (62).

There was good evidence for an association between parental anxiety and report of symptoms in the child, but less evidence for associations with other psychological traits. In models of subjective symptom perception (e.g. (2)), anxiety is thought to heighten attention to bodily sensations and lower the threshold at which sensations are detected (13, 63). In parental perception of symptoms in one's child, heightened parental anxiety may increase attention to the child's behaviour and may cause a more negative interpretation of the reasons underlying ambiguous behaviours. There was also evidence that child anxiety, as well as emotional problems and ADHD, were associated with parental report of physical symptoms. As somatic symptoms are common in children with anxiety (64), and other emotional and behavioural disorders (65), this finding is perhaps unsurprising.

The majority of research investigating the association between behavioural factors and parental symptom report have focused on child, rather than parent, behavioural factors. How child behavioural difficulties, such as having problems with peers, may affect parental symptom report is poorly understood. While all studies investigating child temperament in the review found an association with parent-reported symptoms, no rationale was given for investigating these factors. One mechanism which may explain this pattern of findings is that children perceived as “difficult” may verbally report more symptoms, leading to increased parental symptom report. In addition, parents may pay more attention to their child’s behaviour if they are perceived as “difficult,” causing parents to notice and report more symptoms. Children may also behave differently in the presence of their parents, leading to increased possibility of symptom detection by parents. For example, children display more pain in the presence of a parent than a stranger (66). Better quality research is necessary to clarify the nature of, and reasons underlying, associations between child behavioural factors and parental symptom report.

The effect of some psychosocial factors on parental symptom report were conspicuous by their absence in our review. In particular, only one study investigated the effect of parental expectation of symptoms (50). Given the wealth of evidence suggesting that expectation influences symptom perception in oneself (11, 12, 67, 68), it is surprising that so few studies have investigated the influence of parental expectation on parent-reported symptoms. One possible explanation for this dearth of research is that studies have so far focused on finding factors associated with increases in symptoms experienced by the child, rather than parental report of symptoms. However, given that decision-making about medical treatments or potential lifestyle adjustments will be made based on parental perception and recall of symptoms, it is important to identify factors which may influence this process.

Limitations of studies included in the review

Most studies included in our review were poor quality. In particular, studies fell short on reporting and external validity. Studies used a wide range of questions to assess parental report of symptoms in the child, with very few studies using validated measures. Studies were also heterogeneous with regard to their populations, investigating parents of children of different ages. Statistical analyses were also heterogeneous with some studies using inappropriate tests, not reporting statistical tests used (53, 56), or using small sample sizes. Symptom report was also defined differently by different studies, with some studies using higher thresholds for symptom report than others. Studies included in the review used many different scales to measure the same construct; this was particularly notable for temperament and behaviour (69) and made it difficult to compare results between studies.

Limitations of the review

Several limitations of our review should also be considered. First, symptoms perceived by parents in this review were wide ranging. We were unable to investigate whether predictive factors differed in relation to different symptoms. However, literature investigating the placebo effect supports the notion that factors such as expectations and anxiety are associated with perceiving a wide range of subjective symptoms (11).

Second, we did not differentiate predictors of parent-report of child symptoms by age of the child. This was due to the wide age range used in some studies (e.g. 0 to 18 years) and the small number of studies investigating each factor. While it is likely that some child psychological factors, such as school-based stressors, would be more prevalent in older rather than younger children, no studies included in the review investigated these. The lack of comparable measures for psychosocial factors, such as temperament, across age groups is recognised as a problem for the identification, and relative importance, of factors associated with medically unexplained symptoms in children and adolescents (70).

Third, few studies investigated the same factors, meaning that our conclusions for some risk factors are based on limited results and should be treated with caution.

Fourth, it was notable that only seven citations were identified through our search strategy, with most citations being found through forward citation and reference tracking. To date, parental perception of child symptoms has rarely been studied as a topic in its own right and has no specific easily-searchable terminology, making relevant data difficult to find. It is likely that other studies investigating relevant risk factors exist, but we were unable to locate them.

Fifth, we restricted our search to psychosocial predictors of parental symptom report. Other studies exist investigating personal and clinical factors such as breastfeeding (e.g. (71)), smoke exposure (e.g. (72)), exposure to indoor dampness and mould (73), attending day care (74), and number of siblings (75), particularly in relation to child asthma and allergic symptoms. A full model of parental symptom perception may need to account for these factors.

Sixth, we used parental report of symptoms as a proxy for parental perception of symptoms. Retrospective symptom reports are often biased compared to momentary symptom assessments, with the former often leading to greater estimates of symptoms (76). This is likely due to multiple memory biases playing a role in retrospective reports (see Van den Bergh & Walentynowicz for a review (76)). As diary methodologies were not used by any of the studies included in the review, parental report of symptoms may have been affected by these factors therefore may not have mapped exactly on to symptom perception. However, as retrospective parental reports of symptoms are commonly relied upon by physicians when making diagnoses for children, and by parents when making health-related decisions for their

child, it is important to identify psychological factors which may influence parental report of symptoms in the child.

Lastly, an important question to consider is whether parent and child psychosocial factors are associated with increased symptoms experienced by the child, or increased parental detection of symptoms, irrespective of the child's subjective experience. We were unable to differentiate between these outcomes. This distinction has already been identified as a concern in the literature (55) and it is likely that both mechanisms are relevant (40, 45, 46, 55).

Conclusions

Psychological factors from three categories were found to be associated with parental report of symptoms: affect; behaviour; and expectations, attitudes and beliefs. The influence of both parental and child affect was investigated. Factors most often associated with parental report of symptoms were parent anxiety and stress, and child anxiety, emotional problems and ADHD. Behavioural factors were mostly investigated with reference to the child, with problems in conduct and temperament being consistently associated with greater parental report of symptoms. Beliefs, attitudes and symptom expectations may also influence parent symptom report, but there was a dearth of research investigating these factors. Better quality research using more standardized methods and measures is needed to more fully understand the impact of, and mechanisms through which, psychosocial factors influence parental report of symptoms.

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List of figure captions

Figure 1. Flowchart depicting the selection of studies included in the systematic review with reasons for exclusion

Figure 2. Chart indicating number of studies displaying different aspects of risk of bias

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Table 1. Methods of articles included in systematic review

Reference	Study design (method)	Number of participants (child age)	Inclusion criteria	Risk of bias
Akbarzadeh et al. (2018)(22)	Cross-sectional (questionnaire and interview)	212 (7-16 years. Mean age 9.83 years)	Parents of children with a diagnosis of chronic or recurrent headache in Tehran, Iran	12
Aromaa et al. (1998)(23)	Case-control, as part of wider prospective cohort study (questionnaire)	968 (6 years)	Parents of children in Finnish Family Competence Study with (n=144) and without headache (n=764) in preceding 6 months	9
Baldin et al. (2012)(24)	Cross-sectional (questionnaire)	9679 (7-15 years. Mean 10.83 years)	Parents of school children in all public and private schools in Reykjavik, Iceland school district	8
Borge & Nordhagen (1995)(25)	Prospective cohort (interview)	139 (10 years)	Parents of children in a rural birth cohort in Norway	7
Cerutti et al. (2017)(26)	Cross-sectional (paper questionnaire, delivered to parents by children)	356 (8-15 years)	Parents of children aged 8-15 who were not undergoing pharmacological or psychological therapy, nor had an existing diagnosed infection/other medical illness, in Italy	9
Correia & Linhares (2013)(27)	Case-control (face-to-face interview)	75 (3-5 years)	Mothers of preschool children who were registered in the Family Health Program in South-East Brazil	11
Domenech-Llaberia et al.	Cross-sectional (postal)	807 (3-6 years)	Parents of children attending pre-school public and private	8

(2004)(5)	questionnaires)		nurseries in Spain	
Fabbri et al. (2012)(28)	Prospective cohort (questionnaire)	1674 (7-11 years)	Parents of children born in two areas of Brazil	12
Fearon & Hotopf (2001)(29)	Prospective cohort (interview)	9841 (7-11 years)	Parents of children born in Great Britain from 3-9 March 1958	10
Fryer et al. (2017)(30)	Cross-sectional (questionnaire)	8463 (11 years)	Parents of children in the fifth wave of the UK Millennium Cohort Study	13
Gassmann et al. (2012)(31)	Prospective cohort (questionnaire)	3984 (7-15 years. Mean age 11.3)	Parents of children in the Children, Adolescents & Headache Study ('KiJuKo') in Germany	8
Giacobo et al. (2012)(32)	Cross-sectional (paper questionnaire)	319 (3-6 years)	Parents of children enrolled in specific schools in Barcelona, Spain	9
Gibb (2014)(33)	Cross-sectional (questionnaire and interview)	1368 (7-11 years)	Parents of children at selected schools in England	10
Giray et al (2018)(34)	Cross-sectional (questionnaire)	85 (4-12 years. Mean age 7.1±2.5 years)	Mothers of children with cerebral palsy attending an outpatient clinic between February and April 2016, in Turkey	12
Grunau et al (1994)(35)	Case-control (paper questionnaire at 18-month visit)	195 (18 months)	Case 1, extremely low birth weight: parents of children who weighed less than 801g (n=49). Case 2, extremely low birth weight: parents of children who weighed 801-1000g (n=75).	6

			Control: parents of pre-term children who weighed 1500-2499g (n=42).	
			Control: parents of full-birth-weight children, >2499g (n=29)	
Grunau et al (1994)(36)	Prospective case-control (paper questionnaire at multiple visits, observation of mother-child interaction at 3 year visit)	72 (4.5 years)	Case: extremely low birth weight: parents of children who weighed 1000g or less Control: parents of full-term children with birthweight >2500g	5
Henriksen & Thuen (2015)(37)	Prospective cohort (questionnaire)	8788 (6-11 months)	Mothers of children enrolled in the Norwegian Mother and Child Cohort Study	9
Kilgallen & Gibney (1996)(38)	Cross-sectional (interview-assisted questionnaire)	600 (0-48 months)	Parents of children attending an antenatal or postnatal clinic in two Dublin, Ireland hospitals; or attending some immunisation clinics	7
Köhler et al. (2017)(39)	Cross-sectional (postal questionnaire)	6728 (4 years)	Parents of children in Skåne (Scania), Sweden	13
Link & Fortier (2016)(40)	Cross-sectional (questionnaire, either at home or at scheduled appointment)	353 (0-18 years. Mean age 10.6 years)	Parents of English and Spanish speaking children undergoing treatment and attending routine visit at Hyundai Cancer Institute at Children's Hospital of Orange County, USA between November 2009 and October 2011	12
Litcher et al. (2001)(41)	Cross-sectional (home interviews)	600 (10-12 years)	Parents of children in Kyiv, Ukraine	10

Morris (2006)(42)	Cross-sectional (postal questionnaire)	5474 (7-14 years. Mean age 10.3 years)	Parents of children in the Children, Adolescents & Headache Study in Germany	13
Pitrou et al. (2010)(43)	Cross-sectional (questionnaire)	1308 (6-11 years)	Parents of children in selected primary schools in France	12
Poder et al (2010)(44)	Prospective cohort (telephone questionnaire)	214 (0-18 years)	Parents of children recently diagnosed with cancer who were scheduled for chemotherapy or radiotherapy in certain paediatric oncology centres in Sweden	11
Ramchandani et al. (2005)(45); Ramchandani et al. (2006)(46); Ramchandani et al. (2007)(47)	Prospective cohort (questionnaire)	30 months, n=10,205. 42 months, n=9845. 81 months, n=8272. 7 years	Mothers of children resident in Avon, England, with an expected date of delivery between April 1 st 1991, and December 31 st 1992	14
Rocha et al. (2003)(48)	Cross-sectional (postal questionnaire, and inoculation appointment)	163 (56-68 months. Mean age 62 months)	Mothers of kindergarten children in Canada	6
Smith et al. (2017)(49)	Cross-sectional (online questionnaire)	1001 (2-7 years. Mean age 4.52 years)	Parents of UK children aged between 2 and 7 years on 31 st August 2015 (eligible for the child influenza vaccine)	16
Smith et al. (2018)(50)	Prospective cohort study (online questionnaire)	272 (1-5 years. Mean age 3)	Participants of UK children aged between 2 and 4 years on 31 st August 2016 (eligible for the child influenza vaccine)	16
Soltis & Shelestak (2011)(51)	Prospective cohort (paper)	44 (1 month – 9 years.	Parents of children scheduled for voiding	7

	questionnaire)	Median age 27 months)	Cystourethrogram in Ohio, USA	
Srivastava et al (2001)(52)	Prospective cohort (paper questionnaire)	25 (1 week – 6.5 years. Median age 0.62)	Parents of children referred for a micturating cystourethrogram procedure	6
Stevenson et al. (1988)(53)	Cross-sectional (face-to-face interview)	189 (2.5-3.5 years)	Parents of children aged 2.5 to 3.5 years in the UK	3
Strine et al. (2006)(54)	Cross-sectional (interview)	9399 (4-17 years)	Parents of children in the 2003 National Health Interview Survey Sample Child Core in the USA	16
Wolff et al. (2010)(55)	Prospective cohort (postal questionnaire)	5171 (Questionnaires sent at age 18 months. Mean age 18.4 months)	Parents of children in Generation R Study in Rotterdam, Netherlands	14
Zuckerman et al. (1987)(56)	Prospective cohort (face-to-face interviews)	308 (0-3 years, T1 at 8 months, T2 at 3 years)	Parents of children in a postnatal mothers' group held in London, UK	8

Table 2. Summary of studies investigating the association between psychosocial characteristics and parental report of physical symptoms in the child

Factor	Category	Parent characteristic		Child characteristic	
		Studies finding an association / studies finding mixed evidence	No association found	Studies finding an association / studies finding mixed evidence	No association found
Affect	Anxiety	(55) / (40, 45-47, 50, 51, 52)		(5, 22, 33, 41, 43) / (32)	
	Depression	(56) / (45-47)	(34, 53, 55)	(29, 41) /	(22, 32, 43)
	Attention deficit and hyperactivity			(5, 54) / (45-47)	(31, 32, 43)
	Other psychological disorders	(44)		(5) / (32)	(43)
	Emotional problems			(43, 54) / (25, 45-47)	
	Stress	(55) / (39)	(27)		
	Mental distress	(5, 30) /			(33)
	Stressful/adverse life event	/ (37)		(5, 33) /	(27, 39, 42)
	Perceived lack of emotional or social support	(25) – inverse association (high support, increased symptom report) / (39)	(53, 56)		
Behaviour	Behavioural or conduct problems or disorder			(23, 25, 45-47) / (53, 54, 56)	(31, 32, 43)
	Total strengths and			(28, 30, 43, 45-	

	difficulties (SDQ)	47, 54 /	
	Poor temperament	(45-47) / (35, 36,	
		55)	
	Problem relationship with peers	(54) /	(32, 43, 45-47)
	Parenting style	/ (36, 43)	(35)
Beliefs, attitudes and expectations	Attitudes to intervention	/ (49, 50)	
	Symptom expectation	(50)	
Bold = good and moderate quality studies			

Figure 1. Flowchart depicting the selection of studies included in the systematic review with reasons for exclusion

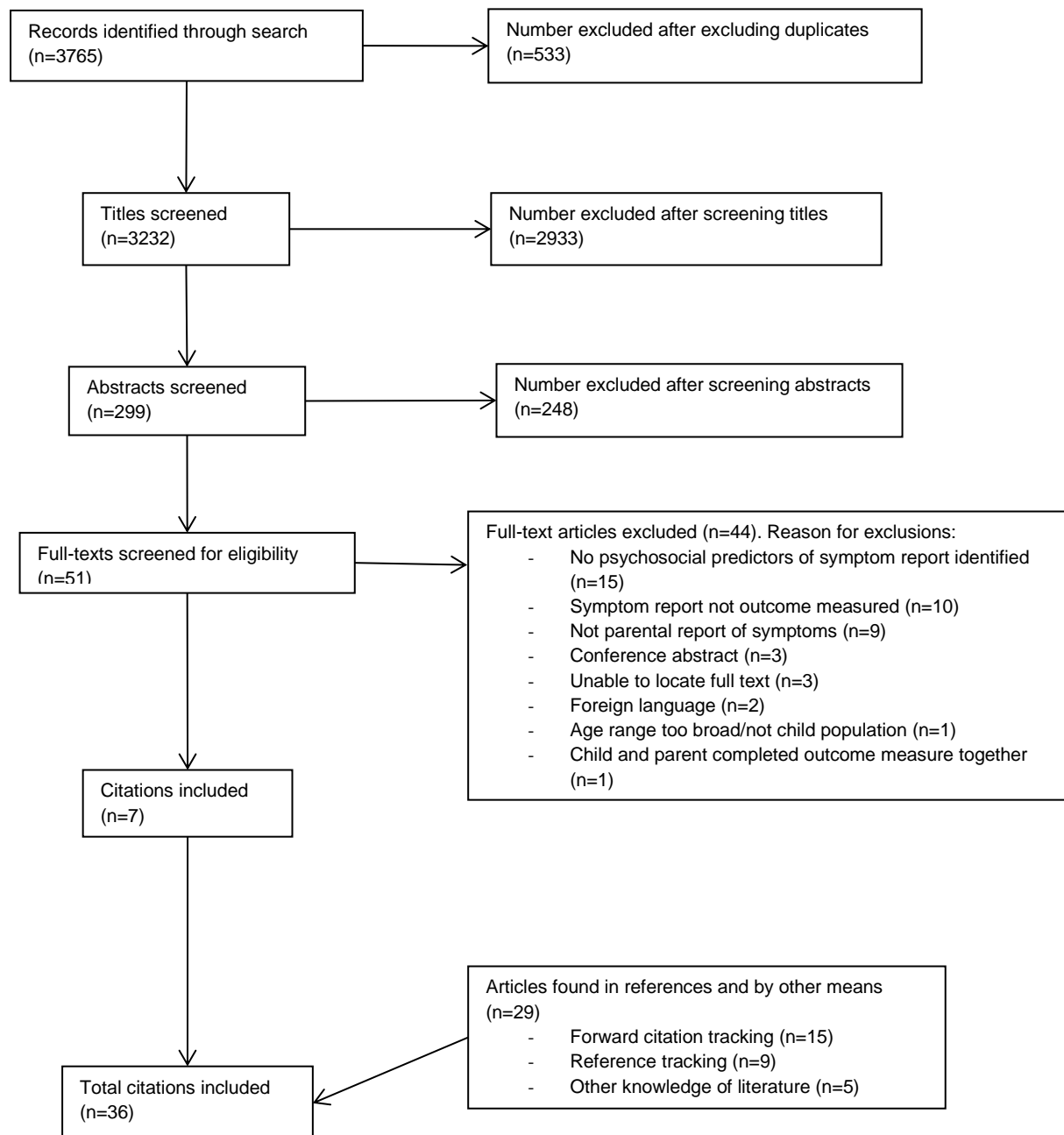


Figure 2. Chart indicating number of studies displaying different aspects of risk of bias

